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An Essay

On Cold and Heat As causes of disease.

Submitted to the Medical faculty of the University of Pennsylvania for the degree of Doctor of Medicine.

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John B. Miley.
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Among the different causes which have been noticed by writers in attempting an explanation of the sources of disease, none which for extent and variety of operation, has been oftener adverted to than the agency of cold and heat.
To agree in this opinion, does not require more than ordinary attention of the observer; as their influence will then be manifested in the production of many of the diseases, to which man is subjected. The influence of cold, and heat, in the earlier ages when the state of society differed widely from that of the present time, probably, did not engage much attention, at least of that kind, which related to an observance of their influence as causes of disease.
This has been observed in all states of society, the nearer they approach a state of nature will there be an exemption from disease, and particularly from such as are referable to atmospheric

vicissitudes or extremes of cold and heat.
In proportion however to the advancement of society in civilization and refinement, mankind became less capable of resisting the operation of external causes, and hence directed their attention to this subject, with the view of obviating their influence, by procuring means of relief or protection.
In extent of operation few causes exert so wide an influence, acting both on vegetable and animal matter and from the presence of moisture and dryness, which are more or less constant in their attendance, and modifying accordingly the influence of cold and heat, will result, the difference of climate and season, and a consequent variety of those diseases depending on these causes.
To this subject I will devote a part of my time, not with the expectation of offering any thing new, but to become more familiar with an

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extensive cause of disease, as with this knowledge their treatment becomes less empirical, less liable to be subverted by theories, and gives more of consistency to the science of medicine without which success will be doubtful.

I am aware of the want of observation on my own part, as well as the experience of others, both of which are requisite in a treatise of this nature, but as I have not entirely neglected either of these, I will endeavour to state briefly the influence of cold and heat, as causes of disease. To the epidemical states of the atmosphere I will not advert, as the subject is too conjectural and obscure for me to engage in an enquiry at this time.

Of Cold

The influence of this agent on the animal economy, is productive of many and important changes, and from its acting frequently, as an exciting cause of disease, makes it more deserving of attention, in which light I shall chiefly confine my remarks.

A moderate degree of cold is not productive of injury, but exerts a salutary influence on the constitution. It contracts the capillaries of the skin, diminishes perspiration, and from the determination to the internal organs, their functions are performed with more energy and activity as that of digestion which is accomplished without the sensation of oppression, and indisposition to motion, so frequently attending this process when much heat prevails.

The circulation becomes slower, fuller, and more regular. Respiration is less hurried, the

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changes in the blood are performed with more facility, from the greater density of the atmosphere, containing in this state a larger proportion of oxygen in the same volume than a heated atmosphere, or a larger quantity of this gas, is required in a given time, than under opposite circumstances, and hence imparting, to the animal breathing it, a greater and more regular supply of heat, as has been noticed among those inhabiting a high northern latitude.

The muscular system ~~requires~~ acquires an increase of development, the more evident when contrasted with the natives of a warm climate. Nor is the nervous system less under the influence of cold, than such parts as have been noticed. The extreme dulness of the mental and corporeal faculties, among the natives of a high northern latitude, furnishes a remarkable instance of its influence.

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Phenomena of this nature may be said to be ~~said~~ to be the physiological change induced by cold, under which, the constitution becomes gradually accommodated, without material injury. The change of a pathological character, are many, and important, and from their frequency of occurence, in countries subject to sudden changes from heat to cold, will induce the belief that few causes operate more extensively in lengthening the catalogue of disease, and bills of mortality.

Cold acts first on the cutaneous surface, and through it on other parts of the system. The morbid effect resulting from long exposure to cold, are evinced on the surface in the chaps chilblains, and gangrenous states of the parts which follow. Its operation is not confined to the morbid changes on the surface only, both the animal, and organic functions, yield alike

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to its influence. A loss of power of locomotion, a general state of insensibility, the diminution in the pulsations of the heart, and arteries as to force and frequency, mark the gradual extinction of life. A memorable example of its pernicious consequences was afforded in the retreat of the French from Moscow.
But it is not from extreme degrees of cold that we are to look for the most of its injurious effects, as by gradual exposure, we finally become capable, of bearing with impunity, those causes of disease, which without this precaution, would have proved a source of destruction.
The custom among the Russians of heating their bodies in the hot bath, and then plunging into snow, affords an example to this effect not less remarkable, than the gradual increase in the exhibition of narcotics.
In proof of the utility of cold in the treatment

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of some inflammatory affections, this example has been cited. Much caution is required on the part of the one who imitates it, as the danger of producing alarming consequences are liable to follow the experiment.
This caution demands stricter attention in proportion as the constitution has been enfeebled by disease, or irregular habits, and the liability in the affection to metastasis.
The majority of those morbid alterations depending on this cause, are principally of an inflammatory character, and are usually prevalent during the winter and spring months, as it is then more commonly combined with moisture, the presence of which, gives facility and energy of effect to cold, and will when thus combined be productive of constitutional derangements which either would not in itself produce.
Cold acts on the system principally through

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the medium of the skin, and from the connexion existing between this tissue, and other portions of the system, there will be afforded an extensive surface to its operation. Of those parts on which its morbid influence is chiefly expended, the fibrous, serous and mucous tissues, stand first in importance. When expended on the fibrous tissues, gout and rheumatism are often the result and a general soreness of the muscular system is not unfrequently the consequence of exposure to cold. When expended on the serous membranes pleurisy, with its analagous affections as peritonitis and inflammation of the membranes of the brain, and swelling of the joints, are of frequent occurrence. If the determination is made towards the mucous surfaces, pneumonia, catarrh the different cynanches, and frequently

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the bowels with inflammation of many other portions of the mucous membranes, will be the result.

Here the same cause will produce a variety of derangements, according to the condition of the system, and the parts on which it may operate. Cold besides exciting into action diseases of an acute inflammatory character becomes also the active agent in the production of those, of a chronic nature, which are not less deserving of attention.

The development of scrofula, in such as are predisposed may in many instances be traced to an exposure to cold.

The prevalence of scrofula, in cold and moist climates, appears to furnish evidence of the influence of this cause.

Among those who are in the habit of using ardent spirits to excess, and then becoming

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exposed to cold, congestion of many of the viscera will result, among which, the brain, usually suffers, from its previous excited condition. Examples of this nature are common among such as crowd the wards of an almshouse. The prevalence of typhus ~~during~~ fever, during the winter months, has been attributed to this cause but other circumstances appear to operate in its production.

Crowded and badly ventilated apartments are supposed to exert an extensive influence.

On this condition of the atmosphere most of the mental affections are aggravated, and their production has been sometimes ascribed to its influence.

Dropsy has been occasionally ascribed to it, with an aggravation of its symptoms when present, and its tendency to bring on attacks of gouty and rheumatic pains, is often experienced

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by those who have been the subjects of these affections, which its influence in many other diseases is not less evident.

It is in this state of the atmosphere that caution is required on the part of the invalid as well as the one in health. The frequent occurrence of catarrh, croup, rheumatism, and bowel complaints, afford many and often alarming instances of its consequences. In those of a scrofulous habit, much caution is required, in guarding against its influence, as when neglected facility of operation is afforded to other causes, often beyond the control, or knowledge, of the practitioner.

The combination of moisture with cold, on board ships, is, when of long continuance, generally productive of ill health, and few causes require to be more strictly guarded.

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against. To this circumstance the production of scurvy has been attributed, and probably the majority of those diseases incident to seamen, may be traced to its influence, tho the fishermen off Newfoundland banks, are generally healthy where fogs and cold weather, are verry prevalent.
Here all the circumstances do not operate, that are usually met with, on board ships, in publick service, a chief one of which, is the crowded condition of the crew, and difference in provision, together with some other accesary causes. A frequent derangement in the digestive functions, is often witnessed in those ~~who~~ who have been the subjects of intemperance, or disease, or whose occupations render them less capable, of resisting, the operation of causes of this character.

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The frequent derangement in the function of menstruation, affords another example of cold being the enemy of health, further instances of which are probably unnecessary to state.

Many and interesting changes both of a physiological, and pathological character are refferable to this cause, but I will not attempt to trace its influence farther, than having now stated, such changes as are most common in occurrence and which I think most deserving of notice.

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Of Heat

The influence of this agent, the operation of which, is so essential, to the existence of animal and vegitable life, and by its presence or absence, giving to each country, its peculiarity of climate, and many of the characteristics, of its inhabitants, will not fail, to exert a less marked influence in the production, and modification, of disease. To this circumstance may be in many instances attributed the diversity in the character of diseases, from the greater intensity, and longer continuance, of its action.

Hence the disease at one time assumes a mild, and manageable character, at another manifests great violence in its symptoms, and becomes difficult in its treatment.

The effect of a high degree of atmospheric heat, is to increase the action of the heart and arteries. This condition of the circulatory apparatus

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tho not opposed to a healthy condition of the system, would eventually if long continued, be productive of disease, were not a provision against its morbid influence made in the simultaneous excitement, of the cutaneous capillaries. These vessels by an increased secretion of perspirable matter restores the heart, and arteries, to their regular order, and the evaporation from the surface diminishes the increased heat. This may be stated as the first effect of heat, and the method provided by nature to protect the economy against its influence.

When it is of longer continuance, the supply of fluid is inadequate to guard the skin against its influence, and it becomes dry, indurated, thickened and of a brownish hue.

Such are a few of the changes depending on this cause, under which the constitution becomes gradually accommodated, without suffering

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any material change of function.
This fact is often witnessed among those who remove from a northern, to a southern latitude. As connected with this subject in a physiological view may be noticed the rapid growth, and decay, of the human constitution, in countries subject to great and constant heat. The mental and corporeal faculties are more quickly developed the sign sooner attained, and all the organs brought into a condition, suited to the completion of function, at an earlier age, than among the natives of colder regions. This is remarkably the case in that of generation, particularly on the part of the female.
Phenomena of this nature are not confined to man only, animals of an inferior grade are also subjected to its influence.
There are many other changes of a physiological

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character referable to this cause, but I shall pass them by, as not in immediate connexion with the subject.

A pathological condition may be induced when the application of heat is prolonged, in constitutions the most vigorous, and with the more facility in proportion as the subject has been debilitated by disease, intemperance or other causes. The skin becomes dry and parched pains of the head, a burning sensation in the stomach, hurried respiration, and as occasionally happens, asphyxia hemorrhage from the nose, lungs, and death. Cases of this kind tho not of frequent occurrence, are sufficiently so to demand some attention of the medical observer. The more chronick effects of heat and those which are of more frequent occurrence, are loss of appetite, faintness, nausea, deficient secretion from the mucous surfaces, inducing an

irritable state of these membranes, and frequent by inflammation, or proneness to this condition from slight causes, manifested in the heat and tenderness of the epigastrium, furred tongue and other signs connected with the digestive functions. In this condition of the mucous membranes their functions will become materially altered, and as that portion which lines the alimentary canal, is the part most subject to derangement, it is to this point that attention will be demanded, as upon a restoration to their healthy action, depends the removal of many other affections that originate in and are kept up by this condition of the primaeviae. From the frequent derangements in the digestive functions among the inhabitants of a warm climate, and also in temperate regions during the warm months, not much doubt is now entertained of the agency of heat in their production.

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Most of the ~~derangements~~ derangements depending on this cause are of a chronick character, and requires from this circumstance more attention, both from the obscurity and difficulty of treatment, attending them. The predisposing cause continuing to operate will generally counteract the means employed for their removal.

Dyspepsia or indigestion may be given as an example of this character, a disease of common occurrence in the tropicks, and its difficulty of removal under such a state of the atmosphere, is often attended with great difficulty, as it is in ~~most~~ most other conditions of the weather.

This complaint like many others has a variety of exciting causes, among which, the one stated is very prolifick, an observation common with ~~to~~ writers on the diseases of hot climates.

Among other affections incident to this portion of the mucous membranes may be enumerated

dysentery and cholera infantum. These diseases are of such frequent occurrence in countries subject to great heat, particularly the former, that it in many instances is endemic as in the tropicks. When this affection is not brought into immediat action by the influence of heat, the lining membrane of the bowels appears to be placed in the condition, most favourable to its development. Hence causes which in a healthy condition of this surface, would fail to awaken ~~any~~ any morbid impression, will now give rise to this disease in its different grades of violence as errors in diet, exposure to cold and many others.

The dysenteric symptoms which result from the application of cold, manifests in an evident manner the connexion between the external, and internal, surfaces. The manner in which heat operates, to produce ultimately

a diseased action or condition of the mucous membranes, appears to be by exciting an undue excitement, and rendering them less capable of resisting the determinations that are suddenly thrown upon them.
But this is wandering from the subject the fact is made evident from its frequent occurrence, and the mode in which it is accomplished, I will not attempt to explain.
Such are a few of the morbid changes dependant for their production on heat.
But there are others which manifest in an equally evident manner, the influence of this agent over the animal economy.
The general prevalence of cholera in hot countries, as the East and West Indies, would seem to be favourable to the idea of heat, acting either as an exciting, or predisposing cause. In more temperate regions this disease

is also met with, but it is usually in the seasons of greatest heat when it occurs.
The great extent to which it prevails in some countries, probably cannot be satisfactorily explained from the operation of heat only, and hence has been attributed to an ~~epi~~ epidemick state of the atmosphere, as a more satisfactory cause of its production. Bilious Colick appears to be also dependant on heat, as its occurrence ~~is~~ is common in situations where cholera is prevalent, there are also other diseases similar in character which might be ~~so~~ traced to this cause, a predisposition to their development being created, by the action of heat, on the digestive mucous membranes.
The greater degree of violence in the fevers of warm climates is referred to the influence of atmospheric heat. In those seasons of greatest heat in temperate latitudes, fevers become

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more prevalent, their attacks more dangerous, and the Treatment more difficult.
Examples of this nature are often met with in the different sections of this country, in the conversion of the common bilious, into the yellow fever. These affections are said to be more readily produced when protracted drought is succeeded by rain, and whether the symptoms attending their progress are increased in violence, from this change, is undetermined. But the number attacked appears to favour the belief that moisture acts as an assistant cause in their production.
When heat is combined with moisture it is productive of much uncomfortable feeling, as a sense of oppression, indisposition to exercise, and fatigue from slight exertion. On this condition of the atmosphere most of the diseases incident to the digestive mucous

membranes become more prevalent. This appears to be the case more particularly as respects dysentery, and cholera infantum.
I have now stated a few of the more prominent diseases incident to one part, and will next attempt to trace the operation of this agent on other portions of the system.
The influence of heat over the nervous system, forms a distinguishing feature among the inhabitants of southern latitudes.
The great degree of irritability, indisposition to exercise, relaxation of the muscular system, and impatience of fatigue may be cited as instances of this nature. The development of an excess of sensibility is the change most deserving of notice, as to this circumstance may be attributed in many instances, the greater degree of violence in the symptoms of diseases, their varying character, and difficulty of management.

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This circumstance will give to causes both external, and internal, a facility of operation, and energy of effect, to which the system with an ordinary degree would have remained unaffected.
The tetanic affections may be instanced as examples of this nature, which though occurring in countries not remarkable for great heat, will be mostly met with, in the hot months of those regions. In warm climates the inhabitants are often attacked with symptoms of this nature, from causes, which in a temperate latitude would fail to excite any morbid impression.
In surgical operations when extensive, the supervention of tetanus, is often the chief cause of fear, and in wounds of all kinds, the danger is greater and the treatment more difficult.
From the intimate connexion between the skin and the different organs of the economy many and important changes will be developed.

from the operation of heat, on that surface.
Those who have treated of this subject, place as first in importance, the relation between the skin, and liver. The importance of this organ in the functions of the economy appears to warrant the remark. The cutaneous surface excited to an increased secretion, a corresponding excitement is developed in the hepatic apparatus, as is shown by an increased secretion of bile, and the general prevalence of bilious diseases, among those residing in warm climates.
Derangements of the nature are more readily produced when there are sudden changes from heat to cold, as is experienced in the tropicks where the heat of the day is oppressive, and the nights often uncomfortably cool.
The same change is common in temperate latitudes, and is productive of similar effects.
This is more especially the case in the autumnal

months in which season the difference in temperature between the day, and night is often considerable, and it is then that the bilious diseases of this country, become prevalent. These complaint have a variety of exciting causes but I have only stated one, which is of acknowledged power. From the continued operation of heat, the liver is rendered liable to derangement both in structure, and function, its secretion becoming so changed, as no longer to answer the purpose intended.

Scirrhous of this gland is not of unusual occurrence, from which circumstance will result, a deficiency in the quantity of its secretion, attended with derangements in the digestive functions, which will continue to operate, as a contributing cause, in the production of many affections that now ail the constitution. for the ~~new~~ removal or palliation of these, our attention.

must be directed to the organs implicated.
Among other derangements incident to the liver, may be noticed as demanding attention, the occurrence of acute, and chronic, hepatitis.
In some sections of the world, as the East Indies this disease is said to be quite common, and in this country particularly to the south it is often met with. This gland is also subject to enlargement and the same may be noticed in the spleen, which derangements are common among the residents of the tropicks, and also with those in more temperate latitudes, during the warmer months. This arises probably as a consequence of the constant irritation of heat, on these organs. In the fevers of hot climates, the brain is generally implicated, whether arising from any direct influence exercised by heat over this organ, or from its sympathy with other parts I will not pretend to assert.

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such are a few of the more prominent derangements consequent on a high range of atmospheric heat, and to cite others would I think be unnecessary as the system is under the influence of a constant stimulus, which must according to the laws of the economy, finally produce a pathological state in those parts, from which, excitement is withdrawn, or on which, it may happen to be concentrated, by causes which operate both externally and internally.

Heat besides acting as a direct cause of disease, will also operate as a remote agent in its action on vegetable and animal matter, causing an evolution of those principles thrown out in the process of decomposition, and which if admitted into the system will be productive of disease. The more rapid decomposition of vegetable and animal matter under such a state of the atmosphere appears to furnish

evidence to this effect. The evolution of miasma which is the product of vegetable and animal matter in a state of decomposition has been long an acknowledged cause of disease. The quantity of this matter will be in proportion to the continuance of heat, and the quantity of matter acted on.

In this country where marsh land abounds and droughts common, its manifestation in the production of disease might be expected, and of this examples are abundant. Tho in many instances a more ready explanation might be found in the vicissitudes of the atmosphere, as has been advanced by Dr J. Belk, in his essay on miasm. Though cold and heat operate extensively in the production of disease, both may under proper regulations become an important agent in their removal.

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diseases the utility in the admission of cool air is now admitted as correct, tho formerly an opposite practice was pursued, in closing the apartment of the sick, to prevent the access of cool air, which plan of treatment did not fail to add to their malignity.
As correct reasoning got the ascendency of bad practice, and false theory, cool air became an important agent in their removal.
The success attending the two modes of practice is pointed out in the exanthemata.
Persons who have remained long in a warm climate, among whom, there are often found various derangements of function, find in this resource, an important, and often the chief reliance, for a restoration of health.
The constitution enfeebled by the long and continued action of heat, requires for its renovation, some agent or means, that will restore

a healthy tone of action to its different organs, without exciting an undue excitement in any one. This remedy is often resorted to by removing to a more temperate region, and the utility and success attending it, is seldom without encouragement to the invalid.

The same may be remarked of those derangements incident to the inhabitants of cold countries, who by removing to a southern latitude, have their sufferings either cured or mitigated, by the more equable diffusion of excitement, and the fluids, upon which depends their removal.

I will now close my remarks on this subject, having stated those diseases which are most common to extremes of cold and heat. The attempt has been but partially performed, and for its imperfections I must request the indulgence of my judges.

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